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EXAMINER	
PRENDERGAST, ROBERTA D	

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2628	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/602,600	IKEUCHI ET AL.	
	Examiner	Art Unit	
	ROBERTA PRENDERGAST	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 May 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-8,10-14 and 16-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-8,10-14 and 16-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 5, 8, 12, 14 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. U.S. Patent No. 6573912 in view of Kawasaki et al. "Image-based rendering for mixed reality", Proceedings 2001 International Conference on **Image Processing, Volume 3, 7-10 Oct. 2001, pages 939-942, Sillion et al., 1997, "Efficient Imposter Manipulation for Real-Time Visualization of Urban Scenery." In the proceedings of EUROGRAPHICS, (September), Volume 16, Issue 3, pages 1-12, Dobashi, et al., "A simple, efficient method for realistic animation of clouds" Proc. of 27th Annual Conference on Computer Graphics and interactive Techniques, ACM Press/Addison-Wesley Publishing Co., New York, NY, pages 19-28 and Han et al. U.S. Patent Application No. 2003/0052878.**

Referring to claim 8, Suzuki et al. teaches an image processing method for generating an image from a predetermined view direction association with an object to be rendered, comprising: optically obtaining a plurality of first images by photographing an object to be rendered from a plurality of different directions (Figs. 1-4; column 1, lines 40-49; column 2, lines 30-37; column 7, lines 26-37 and 50-65; column 9, lines 58-66, i.e. first images are the initial video captured images), generating a second image that

pertains to geometry information of the object to be rendered (Figs. 1-4; column 1, lines 40-49; column 2, lines 37-45, i.e. the second images are the silhouette images); generating a geometrical shape model of the object to be rendered on the basis of the second images using a plurality of voxels (Figs. 1-4; column 1, lines 40-49; columns 2-3, lines 65-3; column 4, lines 13-20; columns 7-8, lines 65-8; column 8, lines 20-50; column 9, lines 32-45; columns 9-10, lines 58-10; column 10, lines 40-57, i.e. an intersection processor feeds a voxel calculator in order to determine the volume); generating a plurality of microfacets (column 3, lines 1-5, i.e. it is understood that microfacets are polygons and all voxels are evaluated to determine the object surface which is output as a triangle mesh model) and generating a third image by selecting texture images from the plurality of first images on the basis of the plurality of photographing directions and view direction, and projecting the selected texture images onto the microfacets (column 3, lines 42-52; column 10, lines 1-18, i.e. the background-subtracted real views and the voxel calculation (microfacets) are provided to each unique network client on demand and a novel view/third image is generated by projecting the real views onto the microfacets according to the perspective selected by the client) but does not specifically teach optically obtaining second images that pertain to distance information of the object to be rendered; generating a plurality of microfacets as two dimensional elements that are each centered inside a voxel; executing a billboarding processing unit that rotates the plurality of microfacets to keep the plurality of microfacets substantially vertical to a view direction and generating a third image by selecting texture images from the plurality of first images on the basis of the plurality of

photographing directions and view direction, and projecting the selected texture images onto the microfacets.

Kawasaki et al. teaches optically obtaining second images that pertain to distance information of the object to be rendered (page 940, Fig. 1 and section 2.1. Image capturing process, i.e. the CCD camera obtains texture images and the range sensor obtains depth/range images that pertain to distance information of the object to be rendered); generating a geometrical shape model of the object to be rendered on the basis of the second images (page 940, Fig. 1 and section 2.1. Image capturing process, i.e. the CCD camera obtains texture images and the range sensor obtains depth/range images that pertain to distance information of the object to be rendered and generates the 3D geometrical shape); and generating a plurality of microfacets (page 940, Fig. 3; section 2.1. Image capturing process; section 2.2. Data structure, i.e. the 3D shape model is a polygonal model indicating that a plurality of microfacets has been generated).

Sillion et al. teaches generating a geometrical shape model of the object to be rendered on the basis of the second images; generating a plurality of microfacets three-dimensionally (pages 6 and 8, section 4.2. Imposter creation, i.e. the geometrical shape model is created by extracting interesting contours from the texture image using the depth image and the geometrical shape model is then triangulated to generate the microfacets) and generating a third image by selecting texture images from the plurality of first images on the basis of the plurality of photographing directions and view direction, and projecting the selected texture images onto the microfacets (page 8,

section 4.2. Imposter creation, subsection on Triangulation and 3D reprojection, i.e. the microfacets are reprojected in 3D using the depth image and then the texture image is applied to the 3D triangles/microfacets to generate a third imposter image that is understood to be a type of billboard image).

Dobashi et al. teaches wherein the second image pertains to distance information of the object to be rendered (page 23: Fig. 6; section 5.2.1 Rendering Clouds, 2nd paragraph, i.e. the texture corresponding to the nearest density of each metaball is mapped onto the corresponding billboard and the billboards are sorted based on their distances from the viewpoint indicating that the geometric information pertains to distance), generating a plurality of microfacets as two dimensional elements that are each centered inside a metaball (page 20, Fig. 1; section 3 Basic Idea; page 21, section 4.1 Growth Simulation, 2nd paragraph; page 23: Figs. 5 and 6; column 1, section 5.2.1 Rendering Clouds, 1st-3rd paragraphs, i.e. the simulation space is divided into n_x x n_y x n_z voxels that correspond to cells/ellipsoids such that a binary value is stored at each voxel to indicate if a cloud image is contained within, the texture images corresponding to the nearest density of each metaball is mapped onto the corresponding billboard and an image is calculated using a plurality of texture-mapped billboards indicating that a plurality of texture-mapped billboards have been generated, the billboards are placed at the centers of the metaballs and the rendering of the clouds is based on a splatting algorithm using billboards such that the number of voxels may be reduced by using coarser voxels in regions distant from the viewer thereby resulting in fewer metaballs thus reducing the computation time of the splatting and rendering

processes, see page 25, Conclusion) and executing a billboarding processing unit which rotates the plurality of microfacets to keep the plurality of microfacets substantially vertical to a view direction (page 23: Figs. 5 and 6; column 1, section 5.2.1 Rendering Clouds, 1st-4th paragraphs, i.e. the plurality of texture-mapped billboards are oriented perpendicularly to the viewpoint and sorted based on their distances from the viewpoint, it is understood that orienting the billboards to the viewpoint requires rotating the plurality of billboards to keep the plurality of microfacets substantially vertical to a viewing direction as claimed).

Han et al. teaches a splatting process for generating a plurality of microfacets as two dimensional elements that are each centered inside a voxel (Abstract; Figs. 2-4 and 6; paragraphs [0037] and [0065]; page 6, claim 1, i.e. the 3d coordinates of the centers of the voxels are obtained and transformed into 2d coordinates of the voxel center and information of the size of the projected voxel image such that a corresponding splat covering the area of the projected voxel is generated thus indicating a 2d element centered inside a voxel as claimed).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Suzuki et al. to include the teachings of Kawasaki et al. Sillion et al., Dobashi et al. and Han et al. thereby providing an optical arrangement equipped with a range sensor to easily measure the precise 3d shape/silhouette of photographed objects such that silhouettes images may be obtained without performing the background subtraction algorithm thus reducing the processing time required (Kawasaki et al. page 940, section 2.1 Image capturing process) that

provides optimal imposters/billboards that correctly produce parallax effects while reducing the number of polygons such that the 3D complexity is minimized to avoid excessive costs (Sillion: page 4, section 3.2. Definition of three-dimensional imposters, 3rd-5th paragraphs) and a simple, easy-to-use, and computationally inexpensive method for creating realistic images using one of the standard graphics APIs, OpenGL thus making it possible to utilize graphics hardware, resulting in fast image generation since billboarding reduces the number of polygons required to generate complex scenes by replacing intricate geometry with simpler texture mapped geometry (Sillion: page 4, section 3.2. Definition of three-dimensional imposters, 3rd-5th paragraphs; Dobashi, et al.; page 19: column 1, Abstract; column 2, section 1. Introduction, lines 5-9, 15-18, 29-32 and 37-50) and further providing a three-dimensional object representation based on depth images that requires a relatively small storage space and allows for fast and high quality rendering while reducing holes (Han et al.: paragraphs [0002], [0004] and [0032]-[0035]).

Referring to claim 12, the rationale for claim 8 is incorporated herein, Suzuki et al., as modified above, teaches a method according to claim 8, teaches selecting at least two first images in ascending order of angle that the view direction and the plurality of photographing directions make, and generating an interpolated image on the basis of the at least two first images, and wherein in texture mapping, the texture images are selected for respective microfacets from the plurality of first images or the interpolated image on the basis of the plurality of photographing directions and view direction, and the selected texture images are projected onto the microfacets (column 2, lines 30-37;

column 3, lines 23-29 and 42-52; column 6, lines 35-46; column 7, lines 50-65; column 10, lines 45-65, i.e. novel views are interpolated from two or more real views and either a real view or an interpolated novel view is mapped/projected onto the microfacets according to the perspective chosen by the client).

Referring to claim 1, the rationale for claim 8 is incorporated herein, Suzuki et al., as modified above, teaches an image processing apparatus comprising:

an optical arrangement (Suzuki et al.: Figs. 1-4; column 7, lines 25-30 and 50-65; column 9, lines 28-33 and 58-64; column 10, lines 35-40, i.e. a system comprised of multiple cameras that capture a plurality of real views; Kawasaki et al.: page 940, Fig. 1 and section 2.1. Image capturing process, i.e. the data acquisition system comprising a CCD camera and a range sensor is an optical arrangement);

a memory (Suzuki et al.: Figs. 1(elements 118-120 and 126), 2(elements 208-210 and 220), 3(elements 308-310 and 320), and 4(elements 408-410 and 420); column 7, lines 26-37; Kawasaki et al.: page 940, Fig. 3; section 2.1. Image capturing process; section 2.2. Data structure, i.e. a 4D texture database indicates a memory; Sillion: page 4, section 3.2. Definition of three-dimensional imposters, 1st paragraph; page 8, section 4.2. Imposter creation, column 1, step 2, i.e. storing three-dimensional information with the image from the outset, storing the depth image in a z-buffer and storing the list of 3D triangles along with the texture image, see steps 2 and 6, indicates a memory storing the plurality of 1st and 2nd images);

a microfacet generation unit; a billboarding processing unit; and a texture mapping unit configured to perform the method of claim 8 (Kawasaki et al.: page 940,

Fig. 1 and section 2.1. Image capturing process, i.e. the data acquisition system comprising a CCD camera and a range sensor is an optical arrangement; Sillion et al.: page 10, section 5.1. Performance, i.e. computing timings for real-time visualization of urban scenery through efficient imposter manipulation on an SGI Indigo2 200 MHz R4400 computer indicates an image processing apparatus having a CPU and a program comprising the structure as claimed above; Dobashi et al.: page 23: Figs. 5 and 6; section 5.2 Hardware-accelerated Rendering Using OpenGL; section 5.2.1 Rendering Clouds, 1^{st}-3^{rd} paragraphs, i.e. it is understood that utilizing graphics hardware to perform billboard processing requires that the graphics hardware include a billboarding processing unit).

The rationale for combining Suzuki et al. with the teachings of Kawasaki et al. Sillion et al., Dobashi et al. and Han et al. as found in the motivation statement of claim 8 is incorporated herein.

Referring to claim 5, the rationale for claims 1 and 12 are incorporated herein, Suzuki et al., as modified above, recites the elements in claims 1 and 12 and further teaches an interpolated image generation unit (column 2, lines 30-37; column 3, lines 23-29 and 42-52; column 6, lines 35-46; column 7, lines 50-65; column 10, lines 45-65, i.e. either the real views or interpolated novel views are mapped to the microfacets according to the perspective chosen by the client). It is inherent that an image processing apparatus capable of performing the method of claim 12 is comprised of an interpolated image generation unit for executing the method as described in claim 12.

Referring to claim 14, the rationale for claims 1 and 8 are incorporated herein, Kawasaki et al., as modified above, teaches a computer program product configured to store program instructions for performing the method of claim 8 (Kawasaki et al.: page 940, Fig. 1 and section 2.1. Image capturing process, i.e. the data acquisition system comprising a CCD camera and a range sensor is an optical arrangement; Sillion et al.: page 10, section 5.1. Performance, i.e. computing timings for real-time visualization of urban scenery through efficient imposter manipulation on an SGI Indigo2 200 MHz R4400 computer indicates an image processing apparatus having a CPU and a program comprising the structure as claimed above; Dobashi, et al.: page 19: Abstract, i.e. using one of the standard graphics APIs, OpenGL, indicates that computer program instructions are stored). It is inherent that graphics hardware capable of performing the method of claim 8 includes a computer system and a computer program product configured to store program instructions for executing the method as described in claim 8.

The rationale for combining Suzuki et al. with the teachings of Kawasaki et al. Sillion et al., Dobashi et al. and Han et al. as found in the motivation statement of claim 8 is incorporated herein.

Referring to claim 18, claim 18 recites the elements in claims 14 and 12 and therefore the rationale for the rejection of claims 14 and 12 are incorporated herein.

Claims 13, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. in view of Kawasaki et al. Sillion et al., Dobashi et al. and Han et

al. as applied to claims 12, 14 and 18 above, and further in view of Neugebauer, P.J., "Geometrical cloning of 3D objects via simultaneous registration of multiple range images"**, Proceedings 1997 International Conference on Shape Modeling and Applications, 3-6 March 1997, pages 130-139.**

Referring to claim 13, the rationale for claim 12 is incorporated herein, Suzuki et al., as modified above, teaches a method according to claim 12 further comprising appending geometry information each pixel of the plurality of first images and the interpolated image on the basis of the second images (column 9,lines 33-44; columns 9-10, lines 64-9, i.e. it is understood that voxel calculation entails appending geometry information, depth information from the second images, to each pixel) but does not specifically teach executing a clipping process of the plurality of first images on the basis of the geometry information of each pixel of each first image and the interpolated image, and a distance from a viewpoint to each voxel.

Neugebauer teaches executing a clipping process of the plurality of first images on the basis of the geometry information of each pixel of each first image and the interpolated image, and a distance from a viewpoint to each voxel (page 135, section 7 Visibility criterion, 1st and 2nd paragraphs; page 137, Fig. 9 and section 8.3. Direct rendering).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Suzuki et al. to include the teachings of Kawasaki et al. Sillion et al., Dobashi et al., Han et al. and Neugebauer thereby providing an optical arrangement equipped with a range sensor to easily

measure the precise 3d shape/silhouette of photographed objects such that silhouettes images may be obtained without performing the background subtraction algorithm thus reducing the processing time required (Kawasaki et al. page 940, section 2.1 Image capturing process) that provides optimal imposters/billboards that correctly produce parallax effects while reducing the number of polygons such that the 3D complexity is minimized to avoid excessive costs (Sillion: page 4, section 3.2. Definition of three-dimensional imposters, 3rd-5th paragraphs) and a simple, easy-to-use, and computationally inexpensive method for creating realistic images using one of the standard graphics APIs, OpenGL thus making it possible to utilize graphics hardware, resulting in fast image generation since billboarding reduces the number of polygons required to generate complex scenes by replacing intricate geometry with simpler texture mapped geometry (Sillion: page 4, section 3.2. Definition of three-dimensional imposters, 3rd-5th paragraphs; Dobashi, et al.; page 19: column 1, Abstract; column 2, section 1. Introduction, lines 5-9, 15-18, 29-32 and 37-50), providing a three-dimensional object representation based on depth images that requires a relatively small storage space and allows for fast and high quality rendering while reducing holes (Han et al.: paragraphs [0002], [0004] and [0032]-[0035]) and further eliminating self-occlusion errors and making it possible to reconstruct concave and convex objects, and even objects with holes out of an arbitrary number of range images (Neugebauer: page 130, Introduction, 3rd paragraph).

Referring to claim 19, claim 19 recites the elements in claims 13, 14, and 18 and therefore the rationale for the rejection of claims 13, 14 and 18 are incorporated herein.

Claims 3, 10, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. in view of Kawasaki et al. Sillion et al., Dobashi et al. and Han et al. as applied to claims 2, 9, and 15 above, and further in view of Ogata et al. U.S. Patent No. 6313841.

Referring to claim 10, the rationale for claim 8 is incorporated herein, Suzuki et al., as modified above, teaches a method according to claim 8, but does not specifically teach wherein the step of generating the geometrical shape mode includes the step of controlling the number of voxels be generated on the basis of precision of the second images.

Ogata et al. teaches wherein the step of generating the geometrical shape mode includes the step of controlling the number of voxels be generated on the basis of precision of the second images (Fig. 16; column 3, lines 10-28; column 10, lines 16-49, i.e. the dataset size is understood to be the number of voxels and is controlled by the level of detail, which is understood to be the precision of the second images).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Suzuki et al. to include the teachings of Kawasaki et al. Sillion et al., Dobashi et al., Han et al. and Ogata et al. thereby providing an optical arrangement equipped with a range sensor to easily

measure the precise 3d shape/silhouette of photographed objects such that silhouettes images may be obtained without performing the background subtraction algorithm thus reducing the processing time required (Kawasaki et al. page 940, section 2.1 Image capturing process) that provides optimal imposters/billboards that correctly produce parallax effects while reducing the number of polygons such that the 3D complexity is minimized to avoid excessive costs (Sillion: page 4, section 3.2. Definition of three-dimensional imposters, 3rd-5th paragraphs) and a simple, easy-to-use, and computationally inexpensive method for creating realistic images using one of the standard graphics APIs, OpenGL thus making it possible to utilize graphics hardware, resulting in fast image generation since billboarding reduces the number of polygons required to generate complex scenes by replacing intricate geometry with simpler texture mapped geometry (Sillion: page 4, section 3.2. Definition of three-dimensional imposters, 3rd-5th paragraphs; Dobashi, et al.; page 19: column 1, Abstract; column 2, section 1. Introduction, lines 5-9, 15-18, 29-32 and 37-50) and further providing a three-dimensional object representation based on depth images that requires a relatively small storage space and allows for fast and high quality rendering while reducing holes (Han et al.: paragraphs [0002], [0004] and [0032]-[0035]) thereby reducing the expensive computing costs due to processing large numbers of voxels (Ogata et al.: column 1, lines 18-27).

Referring to claim 3, claim 3 recites the elements in claims 1 and 10 and therefore the rationale for the rejection of claims 1 and 10 are incorporated herein.

Referring to claim 16, claim 16 recites the elements in claims 10 and 14 and therefore the rationale for the rejection of claims 10 and 14 are incorporated herein.

Claims 4, 6, 7, 11, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. in view of Kawasaki et al. Sillion et al., Dobashi et al. and Han et al. as applied to claims 2, 5, 9 and 15 above, and further in view of Gannett U.S. Patent No. 6118452.

Referring to claim 11, the rationale for claim 8 is incorporated herein, Suzuki et al., as modified above, teaches a method according to claim 8, further comprising appending geometry information to each pixel of the plurality of first images on the basis of the second images (Suzuki et al.: column 9,lines 33-44; columns 9-10, lines 64-9, i.e. it is understood that voxel calculation entails appending geometry information, i.e. depth information from the second images, to each pixel), but does not specifically teach executing a clipping process of the plurality of first images on the basis of the geometry information of each pixel of each first image and a distance from a viewpoint to each voxel.

Gannett teaches executing a clipping process of the plurality of first images on the basis of the geometry information of each pixel of each first image and a distance from a viewpoint to each voxel (column 7, lines 23-45; column 8, lines 34-38; column 9, lines 34-43; column 12, lines 34-51; columns 16-17, lines 55-13, i.e. voxels are eliminated based on a depth buffer test for performing hidden-surface elimination).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Suzuki et al. to include the teachings of Kawasaki et al. Sillion et al., Dobashi et al., Han et al. and Gannett thereby providing an optical arrangement equipped with a range sensor to easily measure the precise 3d shape/silhouette of photographed objects such that silhouettes images may be obtained without performing the background subtraction algorithm thus reducing the processing time required (Kawasaki et al. page 940, section 2.1 Image capturing process) that provides optimal imposters/billboards that correctly produce parallax effects while reducing the number of polygons such that the 3D complexity is minimized to avoid excessive costs (Sillion: page 4, section 3.2. Definition of three-dimensional imposters, 3rd-5th paragraphs) and a simple, easy-to-use, and computationally inexpensive method for creating realistic images using one of the standard graphics APIs, OpenGL thus making it possible to utilize graphics hardware, resulting in fast image generation since billboarding reduces the number of polygons required to generate complex scenes by replacing intricate geometry with simpler texture mapped geometry (Sillion: page 4, section 3.2. Definition of three-dimensional imposters, 3rd-5th paragraphs; Dobashi, et al.; page 19: column 1, Abstract; column 2, section 1. Introduction, lines 5-9, 15-18, 29-32 and 37-50), providing a three-dimensional object representation based on depth images that requires a relatively small storage space and allows for fast and high quality rendering while reducing holes (Han et al.: paragraphs [0002], [0004] and [0032]-[0035]) and further providing significant performance enhancements (Gannett: Abstract; columns 9-10, lines 60-13).

Referring to claim 4, the rationale for claim 11 is incorporated herein, Kawasaki et al., as modified above, recites the elements in claims 1 and 11 but does not specifically teach a clipping process unit.

Gannett teaches a clipping processing unit (Figs. 1A, 1B(element 160) and 2; column 5, lines 8-19; column 7, lines 23-45; column 8, lines 34-38; column 9, lines 34-43; column 12, lines 34-51; columns 16-17, lines 55-13, i.e. voxels are eliminated based on a depth buffer test for performing hidden-surface elimination in processing stages 160-164 of a graphics pipeline indicating a clipping processing unit comprised of processing stages 160-164).

The rationale for combining Suzuki et al. with the teachings of Kawasaki et al. Sillion et al., Dobashi et al., Han et al. and Gannett as found in the motivation statement of claim 11 is incorporated herein.

Referring to claim 17, claim 17 recites the elements of claims 4 and 14 and therefore the rationale for the rejection of claims 4 and 14 are incorporated herein.

Referring to claim 6, claim 6 recites the elements of claims 4 and 5 and therefore the rationale for the rejection of claims 4 and 5 are incorporated herein.

Referring to claim 7, claim 7 recites the elements of claims 4 and therefore the rationale for the rejection of claims 4 is incorporated herein.

Response to Arguments

Applicant's arguments filed 5/14/2008 have been fully considered but they are not persuasive.

Applicant argues that Suzuki et al. does not describe the generation of microfacets as recited in claims 1, 8 and 14 and that the Office Action does not point to any language by column and line in Suzuki where generation of microfacets is described.

Examiner respectfully submits that Suzuki et al. teaches wherein silhouette images are obtained via the silhouette processor disclosed in the NPL titled Appearance-Based Virtual View Generation of Temporally-Varying Events From Multi-Camera Images In The Three-Dimensional Room and that intersections of rays projected through the silhouettes is performed by the intersection processor to output voxels and voxel calculation is performed by a voxel processor to calculate the voxels representing the object such that a volumetric model is obtained and that the voxel calculation and selected real views are supplied to clients to be rendered (column 3, lines 1-5; columns 7-8, lines 65-8; column 8, lines 20-33 and 50-65) thus indicating the generation of a plurality of microfacets to approximate a three-dimensional shape of the geometrical shape model and the generation of a third image as claimed, a copy of the NPL has been provided. It is noted that the specification, see page 12, lines 13-22 and page 13, lines 25-27, refer to microfacets (polygons) and indicate wherein the space is divided into microregions and the microfacets are generated based on voxel subdivision wherein the shape of a microfacet for approximation may adopt a polygonal or elliptical shape, the rectangular shape is adopted for easy use of standard graphic hardware. Thus the microfacets are understood to be polygons and the voxels and triangles of the triangle mesh models are understood to be microfacets.

Applicant next argues that there is no description in Kawasaki of microfacets.

Examiner respectfully submits that Kawasaki et al. teaches that the 3D shape model is a polygonal model, such that after acquiring the image sequence and the 3D shape, the 3D shape is projected to the image in order to acquire the texture image for the mesh wherein the texture image consists of triangle patch textures and the global mesh consists of these triangle patches thus indicating that a plurality of microfacets (triangularly shaped polygons) have been generated to approximate the 3D shape of the object being photographed, see page 940, Fig. 3; section 2.1. Image capturing process; section 2.2. Data structure.

Applicant then argues that Sillion describes extracting interesting contours but never describes generating microfacets.

It is noted that Applicant admits that Sillion teaches that all "vertices of the triangulation is then reprojected in 3D using the information of the depth image and the resulting set of 3D triangles, together with the corresponding texture images, constitute the imposter, see Remarks page 10, lines 13-15.

Examiner respectfully submits that the triangles from which the imposter is formed are understood to be microfacets, as defined in applicant's specification and thus triangulation of the geometrically shaped model, as taught by Sillion, see page 7, Fig. 4(e) and page 8, Identification of important features, 4^{th} paragraph and Triangulation and 3D reprojection, is understood to be a generation of microfacets.

Applicants then argues that there is no support in any of the references of record, particularly Suzuki, Kawasaki, or Sillion, that microfacets are two-dimensional and

geometric in shape and are therefore polygons as asserted by the examiner during the interview conducted May 13th, 2008.

Examiner respectfully submits that Applicant's specification refer to microfacets as polygons and teaches wherein the shape of a microfacet for approximation may adopt a polygonal or elliptical shape, see page 12, lines 13-22 and page 13, lines 25-27, thus the microfacets, as defined in the specification, are understood to be polygons. Examiner further submits that Suzuki et al. teaches wherein each voxel of the volume is evaluated to determine if it lies inside or outside the object such that neighboring voxels having different status (i.e. one inside and one outside) have the property wherein the object surface must pass between them and that this property is then used to extract the object surface as a triangle mesh model (Suzuki et al.: columns 2-3, lines 65-5, i.e. it is understood that each triangle of the mesh is planar and thus two-dimensional), Kawasaki et al. teaches a texture image consisting of triangle patch textures wherein a global mesh consists of these triangle patches, and further teaches a rendering function that represents the RGB value and is defined at each triangle (page 940, section 2.1. Image capturing process; page 941, section 2.3. Image synthesis, i.e. each triangle of the mesh is understood to be a two-dimensional planar polygon). Sillion et al. teaches an external contour considered to be a two-dimensional polygon in the image plane that is subdivided into triangles that can be reprojected in 3D to produce a resulting set of 3D triangles (page 8, section 4.2. Imposter creation, subsection Identification of important features, 3rd paragraph, and subsection Triangulation and 3D reprojection, 2nd paragraph, i.e. each triangle is understood to be a microfacet that is two-dimensional

and geometric in shape such that the triangle itself is planar while its placement may be three-dimensional). Thus all three references teach microfacets that are two-dimensional and geometric in shape as claimed.

Applicant then argues, with respect to Dobashi, that Dobashi clearly states in the sentence bridging columns 1 and 2 of page 23 that “the billboards are placed at the center of each metaball…” and in figures 5 and 6 that metaballs are clearly labeled as containing billboards. Applicant then argues that the discussion of Dobashi bridging pages 6-7 of the Office Action appears to assume that voxels are the same as metaballs but that Dobashi does not contain such a description.

Examiner respectfully submits that Dobashi teaches wherein the cloud simulation space is divided into voxels (volume pixels) such that clouds are rendered using volume rendering techniques, using a splatting method, consisting of two steps wherein the first step calculates the intensity of light reaching the center of each voxel and cloud shadows are obtained as a texture (see page 20, BASIC IDEA). Dobashi further teaches that the color of a voxel depends on the scattered color of the sun, the transmitted color of the sky, and attenuation due to cloud particles and calculation of cloud color using splatting such that the textures for the billboards are precalculated wherein each element of the texture stores the attenuation ratio and cumulative density of the light passing through the metaball in the frame buffer such that the pixel value (the attenuation ratio between the sun and the metaball) corresponding to the center of the metaball is read from the frame buffer, see page 23, section 5.2.1 Rendering Clouds, 2nd paragraph. Dobashi also teaches wherein Figs. 8 and 9 show the simulation

of cloud formation on 256x128x20 cells/voxels and that the cloud evolution is simulated on 256x256x20 cells/voxels for figures 10 and 11, see pages 24-25, section 6. Results, thus the metaballs are being formed in the simulation space wherein the center of the metaballs correspond to pixels in the frame buffer thus indicating that the center of the metaballs corresponds to the cells/voxels of the simulation space.

Applicant then argues that Han does not teach generation of microfacets and that there is no support in Han for the assertion that a splat is the same as a microfacet.

Examiner respectfully submits that Dobashi teaches wherein the billboards are generated using a splatting algorithm and Han teaches obtaining local 3D coordinates of centers of the voxels and transforming them into 2D coordinates of the voxel center and information of the size of the projected voxel image wherein corresponding splats covering the area of the projected voxel image are generated and displayed such that the 3D object is displayed using splats, see paragraph [0037], thus since the area of a voxel is understood to be a rectangular area then the splats are understood to be rectangular as well and thus Han teaches generating microfacets/splats as indicated.

Therefore the combination of primary reference Suzuki with secondary references Kawasaki, Sillion, Dobashi and Han teaches all of the elements of claims 1, 5, 8, 12, 14 and 18 as indicated above.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERTA PRENDERGAST whose telephone number is (571)272-7647. The examiner can normally be reached on M-F 6:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on (571) 272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Roberta Prendergast/
Examiner, Art Unit 2628
6/25/2008

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